filling in the depressions and old valleys of the Mesozoic and Palæozoic rocks, and often containing valuable beds of lignite resulting from the decay of the vegetation which found a congenial soil and climate amongst the lakes and lagoons of the period.

Mr. Hutton considers that there was a "Glacier period" during older Pliocene times, and another of less importance just before the Pleistocene epoch. Both of these are of earlier date than "The Glacial period" of the northern hemisphere, and in the view of the author, as well as of Dr. von Hochstetter and Dr. Haast,[1] were due not to climatical influences extending over the southern hemisphere and differing from those of the present day, but solely to the greater elevation of the land in New Zealand at those periods, and the consequent extension of snow and ice over a larger area than at present.

In Mr. Hutton, "The Theory of the Glacial Origin of Lakes," at least as far as it applies to the province of Otago, finds a new and welcome advocate; and his observations on this question are opportune at this time, as Prof. Ramsay's theory has been challenged by an able writer in the pages of the *Geological Magazine*.[2] Mr. Hutton first examines the views of those who have referred the origin of these lakes in Otago to subsidences, or terrestrial movements, and considering them inadequate, falls back on that of glacial erosion, in support of which he can appeal to the evidence of former glacial action along the shores of the lakes themselves.

The latter portion of the volume before us is taken up with the report of Mr. Ulrich upon the gold-fields of Otago, which is of much local interest, and will doubtless prove of value in guiding future adventurers, but does not appear to call for special observation in a short review.

OUR BOOK SHELF

Elementary Algebra, with Numerous Exercises, for Use in Higher and Middle-class Schools. By David Munn, F.R.S.E. (Collins' School Series, 1876.)

THE chief justification, perhaps, for the production of this work is that the exigencies of a "school series" demanded the publication of an elementary algebra. There is not much more in it than is to be found in a half-dozen similar works, and the explanations of rules seem to us to fall short of those given elsewhere. We do not like the frequent use of *evidently* in an elementary work; our own extended experience with English schoolboys is that these elementary details are by no means evident to the ordinary schoolboy mind. On p. 70 "the L.C.M. of a^3b^2c and $a^2b^3c^2$ will evidently be $a^3b^2c^3$" is evidently wrong, for it evidently ought to be $a^3b^3c^2$. Art. 8 on p. 45 (to show that when a certain algebraical polynomial is divided by $(x-a)$, the remainder is what the polynomial becomes when in it x is changed to a) is useful, and we teach it to advanced pupils, but we are disposed to think that few beginners could grasp the truth and apply it. On pp. 173 to 176 we have some interesting *Miscellaneous Propositions* on the progressions which we do not remember to have seen in previous textbooks. The most important mistakes we have found are on pp. 66, 96, 107, 151, 153. Here we may remark that there is a very plentiful crop of typographical blunders; many of these we are disposed to attribute to a hasty examination of the "proofs;" frequent instances, too, occur in which 2, 3, or 5 have got interchanged. There is a large collection of exercises, but happily no answers are given at the end, or the list of errata would doubtless have been greatly enlarged. From the fact that $(a^m)^n = (a^n)^m$ for positive integers, "it follows that $(a^{\frac{p}{q}})^q = a^p$." This, we think, will hardly be admitted; we should prefer to assume that the result holds, and thence derive an interpretation of $a^{\frac{p}{q}}$. The book takes in Indeterminate Equations, Permutations, Ratio, Proportion, Variation, and the Binomial Theorem. The only Scoticism we have noticed is one that frequently occurs: it is, "we will find," &c.

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]

The Early History of Magnetism

PERMIT me to supplement "K.'s" excellent sketch of the "History of Magnetism" (NATURE, vol. xiii. p. 523) by two notices of the "Mariner's Compass," which seem to be of earlier date than any hitherto found in Europe. They possess particular interest from showing the compass in so rude a state as to lead to the inference that we owe it to a re-discovery rather than to an importation from China. The author of the notices is Alexander Neckam, an English writer of the twelfth century, and they are now included in a book which was privately printed in 1857, entitled "A Volume of Vocabularies," illustrating the condition and manners of our forefathers from the tenth to the fifteenth century, edited from MSS. in public and private collections, by Thomas Wright, M.A., F.S.A., Hon. M.R.S.L., &c. It was through the zeal and the liberality of Joseph Mayer, F.R.A.S., F.S.A., of Bebington, that these notices were brought to light, and a most useful volume was produced, of which he bore the charge.

As the discovery was made by Mr. Wright, it shall be reported in his own words. In referring to the many points of interest upon which new light is thrown by the vocabularies, he says:—

"None of these, perhaps, is of more importance than the curious early allusion to the use of the mariner's compass by the navigators of the western seas. It is well known to all readers that this invaluable invention has been formerly supposed to have been brought from the East, and not to have been known in the West until the fourteenth century, when it was used by the Italian mariners. Allusions to it have, however, been discovered by the students of mediæval literature in works which date as far back as the thirteenth century. In the following pages we find this invention not only alluded to in the twelfth century, but described in such a manner as to show that it was then absolutely in its infancy, and to leave little doubt of its having originated in the West. Alexander Neckam, in his treatise 'De Utensilibus,' enumerates among the ship's stores a needle which was placed on a pivot, and when turned round and left to take its own position in repose, taught the sailors their way when the polar star was concealed from them by clouds or tempest. I have discovered and printed in the note to this passage, a passage in another of Neckam's works, the inedited treatise 'De Naturis Rerum,' which gives a more distinct account of this invention. 'Mariners at sea,' he says, 'when through cloudy weather in the day which hides the sun, or through the darkness of the night, they lose the knowledge of the quarter of the world to which they are sailing, touch a needle with the magnet, which will turn round till, on its motion ceasing, its point will be directed towards the north.' A comparison of these two passages seems to show pretty clearly that at this time the navigators had no regular box for the compass, but that they merely carried with them a needle which had been touched with the magnet (perhaps sometimes they carried the magnet also, and touched the needle for the occasion), and that when they had to use it they merely placed it upon some point, or pivot, on which it could turn with tolerable freedom, and then gave it a motion, and waited until it ceased moving. This mode of

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[1] See Hochstetter's "New Zealand," English translation, p. 504.

[2] No. 139, January 1867. The statements of Mr. Judd have called forth several rejoinders in the ensuing number of the *Magazine* for February.

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using the needle was, it must be confessed, rude enough. The passage in the treatise 'De Utensilibus' contains one particular which is very obscure, as Neckam informs us that when the needle ceased moving it pointed towards the east (*donec cuspis acus respiciat orientem*); and as all the manuscripts agree in this reading, and it is glossed by *est*, this must be the intention of the writer. I know no way of explaining this, unless it be by the supposition that as in the twelfth century, the East was the grand object of most voyages from this part of the world, an attempt had been made to improve the magnetic needle, by adding to it a limb at right angles, which should point to the east when the needle itself pointed to the north, and that this was what Neckam called the *cuspis acus*. Between this and the date—whatever it may be—of the poem, also quoted in my note on the passage of Neckam, which contains the first allusion to the mariner's compass in the thirteenth century, an attempt had been made to facilitate its use.[1] This was done by thrusting the needle through some substance which would not sink, and placing it upon the surface of water. Guiot de Provins, the author of the poem alluded to, calls this substance a *festu*, a stick or straw (the Latin *festuca*). The mariners, he tells us, have a contrivance depending on the magnet, which cannot fail. The magnet, he adds, is an ugly brownish stone, to which iron is attracted. 'After they have caused a needle to touch it, and placed it in a stick, they put it in the water, without anything more, and the stick keeps it on the surface. Then it turns its point towards the star with such certainty that no man will ever have any doubt of it, nor will it ever for anything go false. When the sea is dark and hazy, that they can neither see star nor moon, they place a light by the needle, and then they have no fear of going wrong; towards the star goes the point, whereby the mariners have the knowledge to keep the right way. It is an art which cannot fail.' According to another poet, the substance through which the needle was usually thrust was cork. He tells us that 'the mariners who went to Friesland, or to Greece, or Acre, or Venice' were guided by the polar star; but when at night, or in obscure weather, it was invisible, they discovered its position by the following contrivance:—'They thrust a needle of iron through a piece of cork, so that it is almost buried in it, and then touch it with the loadstone; then they place it in a vessel full of water, so that no one pushes it out until the water is calm, for in whatever direction the point aims, there without doubt is the polar star.' The MS. in which this latter poem was found is undoubtedly of the fourteenth century; but the poem itself is evidently of somewhat older date of the beginning of that century, or not improbably of the century preceding. It is possible therefore that this rudely constructed mariner's compass may have continued unimproved until the fourteenth century."[2] (*Introduction*, pp. 16-18.)

The following is the text of Neckam with the interlinear gloss:—

ille   une pere   faut naute
"Qui ergo vult habere navem, albestum habeat, ne desit ei
fu   aguyl   mis
beneficium ignis.[1] Habeat etiam acum[2] jaculo suppositam,
turne   e enurun   aguyl   poynt   agardet
rotabitur enim et circumvolvetur acus donec cuspis acus respiciat
est   tali modo   i. ubi   mariners
orientem, sic que comprehendunt quo tendere debeant naute cum cinossura" [the cynosure, *κυνόσουρα*, or constellation popularly
atapist   de l'eyr   tempeste   cinossura
called Charles's wain] "latet in aeris turbacione, quamvis ad
achecement   circle   petit
occasum nunquam tendat propter circuli brevitatem." ("De Utensilibus," p. 114.)

Mr. Wright adds: "The earliest account of the mariner's compass, before known, was contained in the following lines of a satirical poem, entitled the 'Bible Guiot de Provins,' composed in the thirteenth century." (Barbazan, "Fabliaux," tom. ii. p. 328.)

"Un art font qui mentir ne puet
Par la vertu de la maniete,
Une pierre laide et brunete,
Où li fers volontiers se joint,
Ont: si esgardent li droit point,
Puis c'une aguile i ont touchié,
Et en un festu l'ont couchié,
En l'eve le metent sanz plus.
Et li festuz la tient desus;
Puis se torne la pointe toute
Contre l'estoile, si sanz doute,
Que jà nus hom n'en doutera,
Ne jà por rien ne fausera.
Qant la mers est obscure et brune,
C'on ne voit estoile ne lune,
Dont font à l'aguille alumer,
Puis n'ont-il garde d'esgarer;
Contre l'estoile va la pointe,
Por ce sont li marinier cointe
De la droite voie tenir.
C'est uns ars qui ne puet failler."

The language of the last extract fully bears out Mr. Wright's estimate of it as not earlier than the thirteenth century.

WM. CHAPPELL

The Dry River-beds of the Riviera

MR. H. T. WHARTON'S letter (NATURE, vol. xiii., p. 448) does not seem fully to explain the difficulty expressed by Mr. R. E. Bartlett (NATURE, vol. xiii., p. 406), a difficulty which is often felt by many of the visitors to the Riviera. Mr. Wharton is quite correct with regard to the Paglione. This stream has, I believe, within the last few years been often in high flood, and has been more than once within a foot or two of the top of the arches of the bridge which Mr. Bartlett seems to think is unnecessarily large. The Paglione, where it passes through Nice, is not, however, a fair representative of the river-beds of the Riviera. When the river-walls were built, which now retain the Paglione, the river-bed was, in all probability, made much narrower than it previously was, on account of the value of the land for building purposes, and only so much of the river-bed retained as was necessary to carry away the water, so that the Paglione now completely fills its channel when in flood. This is far from

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[1] In this interval we meet with another slight but very curious allusion to the use of the magnetic needle for the purposes of navigation. Jacques de Vitri, one of the historians of the Crusades, who wrote about the year 1218, says ("Hist. Hieros," cap. 89):—"Acus ferrea, postquam adamantem contigerit, ad stellam septentrionalem, quæ velut axis firmamenti, aliis vergentibus non movetur, semper convertitur; unde valde necessarius est navigantibus in mari."

[2] This very curious poem, a sort of song, is preserved in a manuscript formerly in the collection of M. Barrois, of Paris, and now in that of Lord Ashburnham. It was first pointed out by M. Fr Michel, who printed the portion relating to the mariner's compass in the preface to his "Lais Inedits" (Paris, 1836). As this is now a rare book, I have thought it desirable to give here the whole passage, as a complement to the extracts given in the note on p. 114 of the present volume. It is as follows:—

"La tresmontaine est de tel guise
Qu'ele est el firmament asisse
Où ele luist et reflambie:
Li maronier qui vont en Frise,
En Gresse, en Acre, ou en Venisse,
Sevent par li toute la voie;
Pour nule riens ne se desvoie,
Tout jours se tient en une moie,
Tant est de li grans li servisse,
Se la mers est enflée ou koie,
Jà ne sera c'on ne le voie,
Ne pour galerne ne pour bise.

Pour bise, ne pour autre afaire
Ne laist sen dout servise à faire
La tresmontaigne clere et pure;
Les maroniers par son esclaire
Jete souvent hors de contraire,
Et de chemin les asséure.
Et quant la nuis est trop oscure,
S'est ele encor de tel nature,
C'à l'aimant fait le fer traire,
Si que par forche et par droiture,
Et par ruille qui tous jours dure,
Sevent le liu de son repaire,
Son repaire sevent à route,
Quant li tans n'a de clarté goute,
Tout chil qui font cest maistrise,
Qui une aguille de fer boute
Si qu'ele pert presque toute
En .i. poi de liége, et l'atise
A la pierre d'aimant bise;
En .i. vaissel plain d'yave est mise,
Si que nus hors ne la deboute,
Si tost com l'iave s'aserise;
Car dons quel part la pointe vise,
La tresmontaigne est là sans doute."

[1] It was believed that the asbestus, when once lighted, could never be extinguished, and hence Neckam recommends it to be carried on shipboard, that the sailors may never be without fire.

[2] This rather obscure description of the mariner's compass, belonging certainly to the twelfth century, is the earliest allusion to the use of that important instrument in the middle ages. Alexander Neckam has, however, given a rather fuller description of it in another of his books, the treatise "De Naturis Rerum," lib. 2, c 89 (MS. Reg. 12 G. xi., fol. 53 v°): "Nautæ etiam mare legentes, cum beneficium claritatis solis in tempore nubilo non sentiunt, aut etiam cum caligine nocturnarum tenebrarum mundus obvolvitur, et ignorant in quem mundi cardinem prora tendat, acum super magnetem ponunt, quæ circulariter circumvolvitur usque dum, ejus motu cessante, cuspis ipsius septentrionalem respiciat." [Here the error about pointing to the east is corrected.]

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